

PATENT

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**ANTONELLA FUSILLO**

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(Signature)

SIR:

Transmitted herewith for filing pursuant to 37 C.F.R. §1.53(b) is the patent application of:

Inventor: WALTER VIEGENER

For: NON-DETACHABLE PRESS FIT ARRANGEMENT BETWEEN A FITTING AND AN END PORTION OF A METAL PIPE

Enclosed are:

- (X) Specification with 21 pages, 21 claims and 5 sheets of drawing.
- (X) Facsimile transmitted copy of Declaration with (X) Power of attorney.
- ( ) Small entity statement.
- (X) Facsimile transmitted copy of Assignment
- (X) Cover letter in compliance with 37 C.F.R. §3.31 to accompany the assignment submitted for recording.
- (X) Check in the amount of \$818.00 for covering the filing fee of \$760.00, the fee of \$18.00 for submitting one claim in excess of twenty and the official fee of \$40.00 for recording the Assignment.
- (X) Self-addressed postcard
- (X) A priority document.
- ( ) Information Disclosure Statement with ( ) PTO-Form 1449 and ( ) copy of reference(s)

(X) The filing fee is calculated as follows:

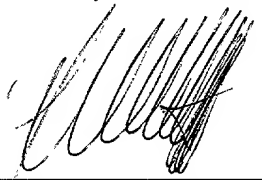
Basic Fee:	\$760.00
Additional Fees:	
Total number of claims: 21-20	\$ 18.00
Number of independent claims: 1-3	\$ 00.00
Reduction by 50% for filing by a small entity	\$
TOTAL	\$778.00

(X) The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No.: 06-0502. A duplicate copy of this sheet is enclosed.

Pursuant to the provisions of 37 C.F.R. §1.10 and §1.53, applicant respectfully requests that this application be assigned an application number and a filing date of November 25, 1998, the date upon which the application was mailed to the Patent and Trademark Office by Express Mail.

Applicant hereby claims priority under 35 U.S.C. §119 (a) - (d) on the basis of German Patent Application No. 297 21 760.7, filed December 10, 1997.

Respectfully submitted,

By:   
Henry M. Feiereisen  
Agent For Applicant  
Reg. No: 31,084

Date: November 25, 1998  
350 Fifth Avenue  
Suite 3220  
New York, N.Y. 10118  
(212) 244-5500  
HMF:af

1                   WALTER VIEGENER, citizen of Germany, whose residence and  
2 post office addresses are Biekhofstrasse 26, 57439 Attendorn, Germany, has  
3 invented certain new and useful improvements in a

4

5

6

7                   NON-DETACHABLE PRESS FIT ARRANGEMENT BETWEEN A

8                   FITTING AND AN END PORTION OF A METAL PIPE

9

10

11

12 of which the following is a complete specification:

Patent 6,700,250

1       NON-DETACHABLE PRESS FIT ARRANGEMENT BETWEEN A  
2               FITTING AND AN END PORTION OF A METAL PIPE

3  
4               CROSS-REFERENCES TO RELATED APPLICATIONS

5  
6               This application claims the priority of German Patent Application Serial  
7       No. 297 21 760.7, filed December 10, 1997, the subject matter of which is  
8       incorporated herein by reference.

9  
10              BACKGROUND OF THE INVENTION

11  
12              The present invention relates to a non-detachable, cold-formed press fit  
13       arrangement between an end portion of a metal pipe in a socket of a fitting, with  
14       the socket formed with an annular anchoring groove facing interiorly of the socket  
15       for receiving a sealing ring.

16  
17              In general, a press fit arrangement between the socket of a fitting and an  
18       end portion of a metal pipe up to an inside diameter of 54 mm is realized by an  
19       electrohydraulic press tool which is provided with a crimping bracket having two  
20       jaws that bound a compression zone. These jaws are swingably mounted to  
21       adapters which extend transversely to the longitudinal axis of the bracket. The  
22       jaws grab around the socket of the fitting in the area of a bead for receiving the  
23       sealing ring and on both sides of the bead. A force is applied immediately before,

1 on and behind the bead to realize a non-detachable joint. Through cold  
2 formation of the bead, the sealing ring is pressed onto the pipe end while  
3 indentations spaced about the circumference are formed before and behind the  
4 bead for plastically deforming the pipe end in the area of the indentations.

5

6 When greater diameters of metal pipes are involved, the use of a crimping  
7 bracket whose jaws are directly placed over a fitting is inadequate to effect a cold  
8 forming operation of the fitting and the inserted end portion of the metal pipe. In  
9 order to non-detachably bond pipes with an inside diameter of 70, 80 or 100 mm  
10 through cold forming, the use of electrohydraulically operated tools is known  
11 which are however bulky and difficult to handle. These tools are provided with a  
12 wraparound ring which is placed over the socket of a fitting after inserting the end  
13 portion of the metal pipe in the socket. By means of the wraparound ring, the  
14 inwardly open bead, which receives the sealing ring, and the area of the socket  
15 neighboring the bead together with the pipe portion located in this area are  
16 commonly deformed in a triangular shaped manner, whereby the sides of the  
17 triangle assume a curved configuration and the corners are rounded.

18

19 It is also known to provide the fitting with smooth ends and to produce the  
20 bond between one end of the fitting and an end portion of the metal pipe by  
21 utilizing a socket in which the end of the fitting and the end portion of the metal  
22 pipe are inserted, and which is slotted in longitudinal direction. The width of the  
23 slot can be decreased by means of locking screws so that the socket is pressed

1 onto the ends of the fitting and the metal pipe. A seal is placed in the socket for  
2 circumscribing the ends of the fitting and the metal pipe.

3

4

## SUMMARY OF THE INVENTION

5

6 It is an object of the present invention to provide an improved press fit  
7 arrangement between a fitting and a metal pipe, obviating the afore-stated  
8 drawbacks.

9

10 In particular, it is an object of the present invention to provide an improved  
11 press fit arrangement for use with metal pipes of an inside diameter exceeding  
12 54 mm, which realizes a round or substantially round cross-section of the socket  
13 even in the crimped end state whereby the sealing forces and holding forces  
14 about the entire circumference are the same or substantially the same.

15

16 These objects, and others which will become apparent hereinafter, are  
17 attained in accordance with the present invention by providing a socket which is  
18 formed with an annular anchoring groove facing inwardly for receiving a sealing  
19 ring, and by securing at least one holding element to the socket and cold forming  
20 the holding element together with the socket, with the holding element at least  
21 partially penetrating the material of the end portion of the metal pipe to realize a  
22 positive fit with the metal pipe.

23

1           According to one embodiment of the invention, the socket is formed  
2   adjacent the anchoring groove for the sealing ring with an annular receiving  
3   groove facing the interior space for receiving the holding element, whereby the  
4   holding element is provided with projections spaced about the circumference of  
5   the holding element and pointing towards the end portion of the metal pipe, or  
6   with a circumferential cutting edge extending towards the end portion of the metal  
7   pipe. When cold forming the socket of the fitting, the projections or the cutting  
8   edge realize the positive fit between the holding element and the end portion of  
9   the metal pipe.

10  
11           The holding element may be a ring formed with an axial slot, with the  
12   ring-shaped holding element having a cross section in the form of a vertex of a  
13   triangle (or pointed roof configuration), or a curved cross section or a polygonal  
14   cross section. It is also possible to configure the receiving groove with a conical  
15   base, whereby the holding element has a cross sectional contour which  
16   complements the conical base of the receiving groove and includes a free edge  
17   of small diameter for penetration into the end portion of the metal pipe after  
18   radially compressing the socket.

19  
20           According to another feature of the present invention, the socket of the  
21   fitting may also be provided adjacent the entry opening for the metal pipe with an  
22   outwardly directed annular anchoring groove for accommodating an anchoring  
23   flange of a sleeve-like holding element.

1 According to still another feature of the present invention, the anchoring  
2 groove is formed in a bead of the socket, with the holding element being a  
3 stepped sleeve having a first portion of smaller diameter and a second portion of  
4 greater diameter, with the second portion overlapping the bead of the socket, and  
5 with the first portion surrounding the metal pipe. After crimping operation, the  
6 holding element matches the outer contour of the socket, with the first portion of  
7 the stepped sleeve denting the material of the metal pipe.

8  
9 Suitably, the socket of the fitting has an outer peripheral surface provided  
10 with an engagement member in form of a circumferential groove, lobes, ribs or  
11 circumferential fins for attachment of a press tool, preferably a wraparound chain.

12  
13 According to yet another feature of the present invention, the holding  
14 element has a hardness exceeding a hardness of the metal pipe. Preferably, the  
15 holding element is made of special steel.

16  
17 A press fit arrangement in accordance with the present invention realizes  
18 a positive fit between the holding element, which is secured to the socket of the  
19 fitting, and the metal pipe by providing the holding element with spikes, teeth,  
20 crawls or cutting edges which dig into the material of the end portion of the metal  
21 pipe during crimping operation. It is also possible to provide the holding element  
22 in the form of an axially slotted sleeve which surrounds the metal pipe and  
23 partially dents the material of the metal pipe.



## BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will now be described in more detail with reference to the accompanying drawing in which:

FIG. 1 is a longitudinal section of a press fit arrangement according to the present invention for joining a fitting and an end portion of a metal pipe;

FIG. 2 is a longitudinal section of the press fit arrangement, showing the end portion of the metal pipe inserted in a socket of the fitting and a press tool attached to the socket for carrying out a crimping operation;

FIG. 3 is a longitudinal section of the press fit arrangement after realizing a non-detachable positive fit between the fitting and the end portion of the metal pipe;

FIGS. 4 to 6 are enlarged sectional views of various stages for realizing a non-detachable positive connection between the fitting and the metal pipe;

FIG. 7 is a longitudinal section of a press fit arrangement

1 according to the present invention, showing a variation of the holding element  
2 and associated receiving groove in the socket, for realizing the non-detachable  
3 positive connection between the fitting and the metal pipe;

4

5 FIGS. 8 to 11 are longitudinal sections of press fit arrangements  
6 according to the present invention, showing further variations of the type of  
7 holding element shown in FIG. 7;

8

9 FIG. 12 is a longitudinal section of a press fit arrangement  
10 according to the present invention, showing a modified type of holding element  
11 and associated receiving groove in the socket, with the holding element  
12 projecting outward beyond the area of the socket; and

13

14 FIGS. 13 to 18 are longitudinal sections of press fit arrangements  
15 according to the present invention, showing further variations of the type of  
16 holding element shown in FIG. 12.

17

## 18 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

19

20 Throughout all the Figures, same or corresponding elements are generally  
21 indicated by same reference numerals.

22

23 Turning now to the drawing, and in particular to FIG. 1, there is shown a

1 longitudinal section of a press fit arrangement according to the present invention  
2 for joining a fitting, generally designated by reference numeral 1 and an end  
3 portion 4 of a metal pipe. The fitting 1 includes a spigot 2, which is provided with  
4 an external thread for attachment e.g. to another pipe (not shown), and a  
5 socket 3 for receiving the pipe end 4. The socket 3 has an inside diameter which  
6 corresponds to the outside diameter of the pipe end 4 and is formed interiorly  
7 with a circumferential annular stop surface 5 for interaction with an end face 6 of  
8 the pipe end 4 to thereby restrict the entry path of the pipe end 4.

9  
10 The socket 3 defines an interior space 7 and is provided with an anchoring  
11 groove 8 which is open towards the interior space 7 for accommodating a sealing  
12 ring 9. Positioned near the entry opening for the pipe end 4 at an axial distance  
13 to the sealing ring 9, the socket 3 is further provided with a receiving groove 11  
14 for securement of a holding element 10. In the exemplified embodiment of FIG. 1,  
15 the holding element 10 is ring-shaped and slotted in longitudinal direction to form  
16 a plurality of projections 12 which are spaced about the circumference of the  
17 holding element 10 and point in the direction of the pipe end 4. Suitably, the  
18 holding element 10 is situated between the sealing ring 9 and the free end of the  
19 fitting 1, thereby ensuring that the holding element is prevented from contacting  
20 liquid transported under pressure in the metal pipe.

21  
22 In the non-limiting example of FIG. 1, the sealing ring 9 is formed by an  
23 O ring of relatively small cross section; However, it is certainly within the scope of

1 the present invention to provide the sealing ring 9 as lip seal or as matched  
2 annular formed body.

3

4 The holding element 10 is positively fitted or resiliently installed in the  
5 receiving groove 11, whereby a spring-mounted installation of the sealing ring 9  
6 enables a compensation of tolerance deviations between interacting  
7 components.

8

9 After inserting the pipe end 4 through the entry opening of the socket 3  
10 until the end face 6 of the socket 3 impacts the stop surface 5, a press tool 13,  
11 shown only schematically in FIG. 2, is attached from outside to the socket 3 for  
12 subsequent execution of the crimping operation. Suitably, the socket 3 of the  
13 fitting 1 is formed about its outer peripheral surface with a circumferential groove  
14 21 for receiving a complementary rib 13' of the press tool 13, preferably a  
15 wraparound chain of the press tool 13. Persons skilled in the art will understand  
16 that instead of the described circumferential groove, the socket 3 may also be  
17 formed with lobes, ribs or circumferential ridges for cooperation with  
18 complementary components on the press tool 13.

19

20 As shown in particular in FIG. 4, the projections 12 of the holding  
21 element 10 are pointed toward the outer surface area of the pipe end 4. During  
22 radial crimping operation, liquid flowing through the metal pipe 4 is kept away  
23 from the holding element 10 as a result of the interference fit of the sealing ring 9

1 upon the pipe end 4 whereas the projections 12 of the holding element 10 dig  
2 into the material of the pipe end 4, as shown in FIG. 3 and in particular in FIG. 5.  
3 Thus, the socket 3 of the fitting 1 is positively attached to the pipe end 4. After  
4 removing the press tool 13, a slight recoil of the cold formed fitting parts is  
5 encountered; However, during the slight recoil, the projections 12 of the holding  
6 element 10 remain entrenched in the material of the pipe end 4. The final state of  
7 the crimping operation is shown in FIG. 6.

8  
9 By radially crimping the socket 3 of the fitting 1 with the inserted pipe  
10 end 4 by means of the press tool 13, a round cross section of the socket 3 is  
11 substantially retained while the particular configuration and arrangement of the  
12 holding element 10 results in same or substantially same holding forces around  
13 the circumference of the socket 3. The same is true for the sealing forces which  
14 are applied between the sealing element 9 and the pipe end 4 as a result of the  
15 radial deformation of the anchoring groove 8 during crimping operation.

16  
17 Persons skilled in the art will understand that even though the press fit  
18 arrangement shown in the drawings uses only a single holding element 10, it is  
19 certainly within the scope of the invention to secure several holding elements in  
20 the receiving groove 11.

21  
22 In describing the following Figures, like parts of the press fit arrangement,  
23 in particular the holding element 10 and the associated receiving groove 11, will

1 be identified by corresponding reference numerals followed by a distinguishing  
2 lower case character.

3

4 Turning now to FIG. 7, there is shown a longitudinal section of a modified  
5 press fit arrangement 1 which includes a holding element 10a and associated  
6 receiving groove 11a in the socket 3 for realizing the non-detachable positive  
7 connection between the fitting 1 and the pipe end 4. The holding element 10a is  
8 ring-shaped and slotted in longitudinal direction, and the receiving groove 11a is  
9 formed with a conical base 14, whereby the cross-sectional contour of the  
10 holding element 10a is matched to the contour of the base 14. The holding  
11 element 10a thus has the shape of a truncated cone, with the free edge on the  
12 end of smaller inside diameter penetrating the material of the pipe end 4 after  
13 radial crimping operation.

14

15 In the embodiment of the press fit arrangement of FIG. 8, the holding  
16 element 10b has a cross section in the form of a vertex of a triangle (i.e. pointed  
17 roof configuration). At radial crimping operation of the fitting 1 and the pipe end 4,  
18 the free edges 18 of the holding element 10b penetrate the material of the pipe  
19 end 4. In FIG. 9, the positive fit during crimping operation is realized in the same  
20 manner by the free edges 18 of the holding element 10c which however has an  
21 arched configuration. In FIG. 10, the holding element 10d is of polygonal  
22 configuration, with the free edges 18 penetrating the material of the pipe end 4.

23

1           FIG. 11 shows a press fit arrangement 1 in which the holding element 10e  
2   is of annular configuration and slotted in longitudinal direction. The holding  
3   element 10e is arranged in the receiving groove 11e of the socket 3 and is  
4   provided on its side distant to the sealing ring 9 with a conical surface 23. The  
5   conical surface 23 interacts with an opposite complementary conical surface 24  
6   on the inside of the socket 3 of the fitting 1 so that the projections 12e in the form  
7   of teeth or the like on the side proximal to the sealing ring 9 penetrate the  
8   material of the pipe end 4 when the socket 3 and the pipe end 4 are pressed  
9   together. As stated above, it is certainly possible to use instead of a ring-shaped  
10   holding element, several holding elements in the form of ring segments which are  
11   arranged in the receiving groove 11e.

12  
13           Turning now to FIG. 12, there is shown a longitudinal section of a further  
14   variation of a press fit arrangement 1 according to the present invention, in which  
15   the holding element 10f is of sleeve like configuration and slotted in axial  
16   direction. The socket 3 is formed with an annular receiving groove 11f which is  
17   open towards the pipe end 4 to bound with the outer peripheral surface of the  
18   pipe end 4 an annular gap 29 at the end face of the fitting 1 for passage of the  
19   holding element 10f and securement of an anchoring flange 27 inside the  
20   receiving groove 11f, with the anchoring flange 27 being formed in one-piece with  
21   the holding element 10f. The sleeve-like holding element 10 thus projects  
22   outward beyond the area of the socket 3 and surrounds the pipe end 4. When  
23   operating the press tool 13, a portion 10'f of the holding element 10f dents

1 the material of the pipe end 4 during crimping operation, and the sealing ring 9 is  
2 squeezed between the socket 3 and the outer peripheral surface of the pipe  
3 end 4, resulting in a positive fit between the holding element 10f and the pipe  
4 end 4, as shown in FIG. 13.

5

6 In the embodiment of the press fit arrangement 1 according to FIG. 14, the  
7 socket 3 is surrounded by a holding element 10g which has a sleeve-like  
8 configuration and is slotted in longitudinal direction. The holding element 10g is  
9 also provided with an annular anchoring flange 32 which engages in the  
10 receiving groove 11g. On its side distant to the anchoring flange 32 and facing  
11 the pipe end 4, the holding element 10g is provided with teeth 31 which dig into  
12 the material of the pipe end 4 when compressing the socket 3 and the holding  
13 element 10g onto the pipe end 4, to thereby realize a positive fit between the  
14 holding element 10g and the pipe end 4.

15

16 FIG. 15 shows a variation of the press fit arrangement 1 in which the  
17 holding element 10h is a sleeve slotted in longitudinal direction and formed in  
18 one piece with an inwardly directed flange ring 36 for engagement in an  
19 outwardly open receiving groove 37 of the socket 3 of the fitting 1. The holding  
20 element 10h is formed with inner teeth 31 which penetrate the material of the  
21 pipe end 4 during crimping operation for realizing a positive fit.

22

23 FIG. 16 shows a holding element 10i which unlike the holding element 10h



1 is not serrated but is provided with a smooth sleeve to surround the pipe end 4,  
2 and is slotted in longitudinal direction. A crimping operation of the holding  
3 element 10i and the socket 3 with the pipe end 4 results in a common permanent  
4 deformation between a sleeve portion 10'i of the holding element 10i and the  
5 pipe end 4.

6  
7 FIG. 17 shows a holding element 10k which is formed as stepped sleeve  
8 having an inward portion 40 of greater inside diameter and an outward portion 42  
9 of smaller inside diameter. The portion 40 overlaps a bead 41 which forms  
10 interiorly the anchoring groove 8 for the sealing ring 9, whereas portion 42  
11 surrounds the pipe end 4. After crimping the sleeve-like holding element 10k,  
12 which preferably is slotted in axial direction, with the socket 3 of the fitting 1 and  
13 the pipe end 4, the holding element 10k follows the contour of the socket 3, while  
14 a portion 10'k of the holding element 10k is compressed into the pipe end 4 to  
15 commonly deform these parts, as shown in FIG. 18.

16  
17 Preferably, the holding element 10 has a hardness which exceeds the  
18 hardness of the metal pipe. Suitably, the holding element 10 is made of special  
19 steel.

20  
21 Although in the preceding examples of the press fit arrangement, the  
22 holding element is generally shown at a location between the sealing ring 9 and  
23 the free end of the fitting 1 or also projecting beyond the free end of the fitting 1,

1 it is also possible to position the holding element in a region between the stop  
2 surface 5 and the sealing ring 9. In this case, the holding element comes into  
3 contact with the liquid transported in the metal pipe so that the holding element  
4 should be made of corrosion-resistant material.

5

6 While the invention has been illustrated and described as embodied in a  
7 non-detachable press fit arrangement between a fitting and an end portion of a  
8 metal pipe, it is not intended to be limited to the details shown since various  
9 modifications and structural changes may be made without departing in any way  
10 from the spirit of the present invention.

11

12 What is claimed as new and desired to be protected by Letters Patent is  
13 set forth in the appended claims:

## CLAIMS

What is claimed is:

1. In a non-detachable press fit arrangement between an end portion of a metal pipe and a socket of a fitting, with the socket defining an interior space and being formed with an annular anchoring groove facing the interior space for receiving a sealing ring, said press fit arrangement comprising at least one holding element secured to the socket and cold formed together with the socket, said holding element at least partially penetrating the material of the end portion of the metal pipe to realize a positive fit with the metal pipe.

2. The press-fit arrangement of claim 1 wherein the socket is formed adjacent the anchoring groove for the sealing ring with an annular receiving groove facing the interior space for receiving the holding element, said holding element being provided with a material penetrating component for realizing the positive fit between the holding element and the end portion of the metal pipe when cold forming the socket of the fitting, said component being selected from the group consisting of projections spaced about the circumference of the holding element and pointing in the direction of the end portion of the metal pipe, and a cutting edge arranged about the circumference of the holding element and extending to the end portion of the metal pipe.

1 3. The press-fit arrangement of claim 1 wherein the holding element is a ring  
2 formed with an axial slot.

1 4. The press-fit arrangement of claim 3 wherein the ring-shaped holding  
2 element has a cross section selected from the group consisting of vertex of  
3 a triangle, curved and polygonal.

1 5. The press-fit arrangement of claim 2 wherein the receiving groove has a  
2 conical base, said holding element having a cross sectional contour which  
3 complements the conical base, and including a free edge of small diameter  
4 for penetration into the end portion of the metal pipe after radially  
5 compressing the socket.

1 6. The press-fit arrangement of claim 2 wherein the holding element is  
2 mounted by way of a positive fit into the receiving groove.

1 7. The press-fit arrangement of claim 2 wherein the holding element is  
2 resiliently mounted into the receiving groove.

1 8. The press-fit arrangement of claim 1 wherein the holding element is  
2 arranged between the sealing ring and a free end of the fitting.

1 9. The press-fit arrangement of claim 1 wherein the socket of the fitting has an  
2 outer peripheral surface formed with an engagement member selected from  
3 the group consisting of circumferential groove, lobes, ribs and  
4 circumferential fins for attachment of a press tool.

1 10. The press-fit arrangement of claim 9 wherein the press tool is a wraparound  
2 chain.

1 11. The press-fit arrangement of claim 1 wherein the socket of the fitting is  
2 substantially round after being compressed, with sealing forces and holding  
3 forces applied between the socket and the end portion of the metal pipe  
4 being substantially evenly distributed about the circumference of the metal  
5 pipe.

1 12. The press-fit arrangement of claim 1 wherein the holding element is a ring  
2 having one side, which faces the sealing ring, and an opposite side, said  
3 one side being formed with projections which penetrate into the material of  
4 the metal pipe when being cold formed, and said opposite side being  
5 formed with a conical surface which cooperates with a conical surface of the  
6 fitting.

1 13. The press-fit arrangement of claim 2 wherein the holding element is a  
 2 sleeve which is slotted in the axial direction and formed with an anchoring  
 3 flange engaging in the receiving groove of the socket, said holding element  
 4 traversing an annular gap formed between an end face of the fitting and the  
 5 end portion of the metal pipe to extend outwards for surrounding the metal  
 6 pipe, whereby through application of a press tool a portion of the holding  
 7 element is capable to dent the metal pipe.

1 14. The press-fit arrangement of claim 13 wherein the portion of the holding  
 2 element has an inner surface formed with teeth.

1 15. The press-fit arrangement of claim 1 wherein the socket has an end face  
 2 forming an entry opening for the end portion of the metal pipe, said socket  
 3 being formed in close proximity to the end face with a ring-shaped receiving  
 4 groove which is open to the outside for receiving an anchoring flange of the  
 5 holding element, said holding element being an axially slotted sleeve which  
 6 surrounds the metal pipe and partially dents the material of the metal pipe.

1 16. The press-fit arrangement of claim 15 wherein the sleeve has an inner  
 2 surface formed with teeth.

1 18. The press-fit arrangement of claim 1 wherein the holding element has a  
2 hardness exceeding a hardness of the metal pipe.

1 19. The press-fit arrangement of claim 1 wherein the holding element is made  
2 of special steel.

1 20. The press-fit arrangement of claim 1 wherein the sealing ring is a seal  
2 selected from the group consisting of lip seal, O ring or matched formed  
3 part.

1 21. The press-fit arrangement of claim 1 wherein the sealing ring has a  
2 relatively small cross section.

## ABSTRACT OF THE DISCLOSURE

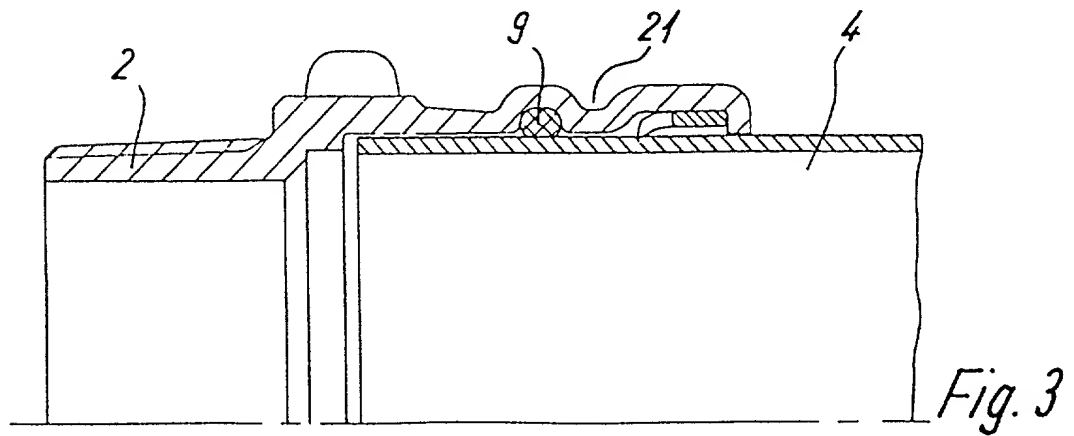
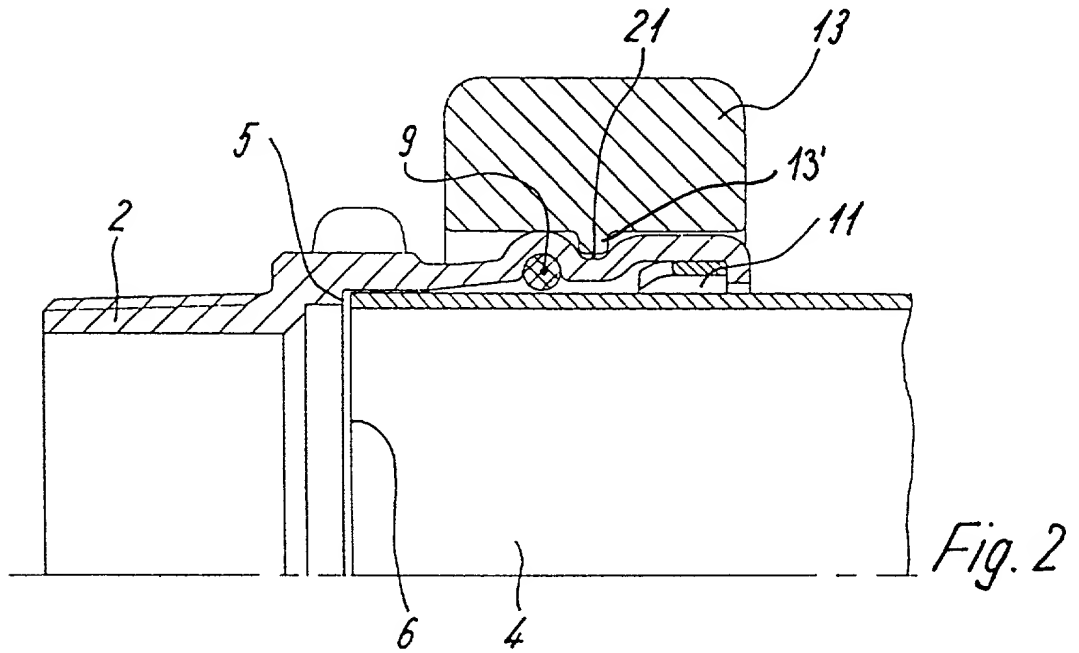
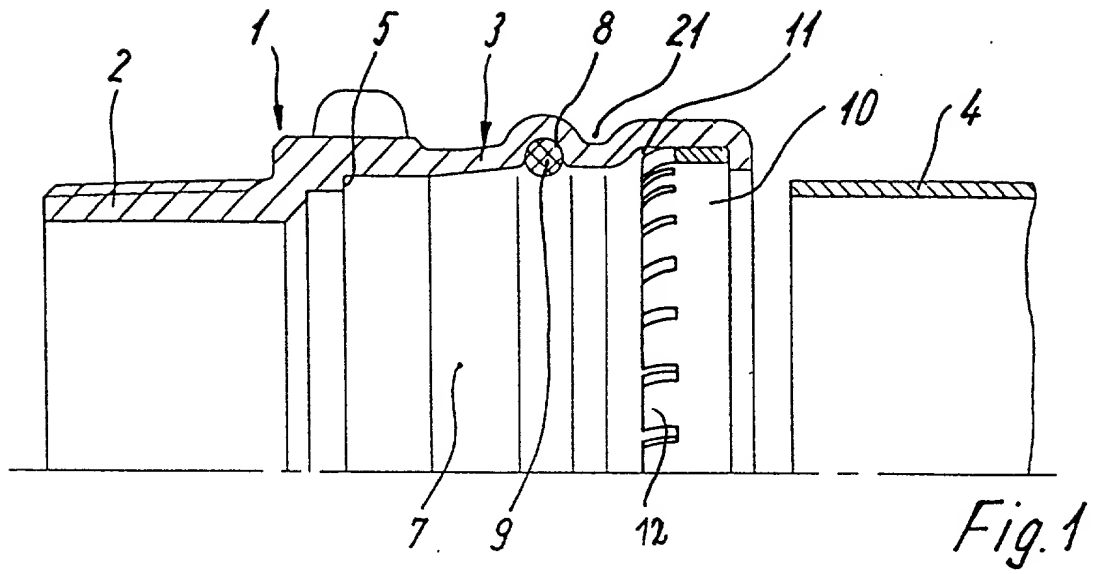
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3        In a non-detachable press fit arrangement between an end portion of a  
4 metal pipe and a socket of a fitting, the socket defines an interior space and is  
5 formed with an annular anchoring groove which faces the interior space for  
6 receiving a sealing ring. The press fit arrangement includes at least one holding  
7 element secured to the socket and cold formed together with the socket, whereby  
8 the holding element at least partially penetrates the material of the end portion of  
9 the metal pipe to realize a positive fit with the metal pipe.



Pub. No. 527,002



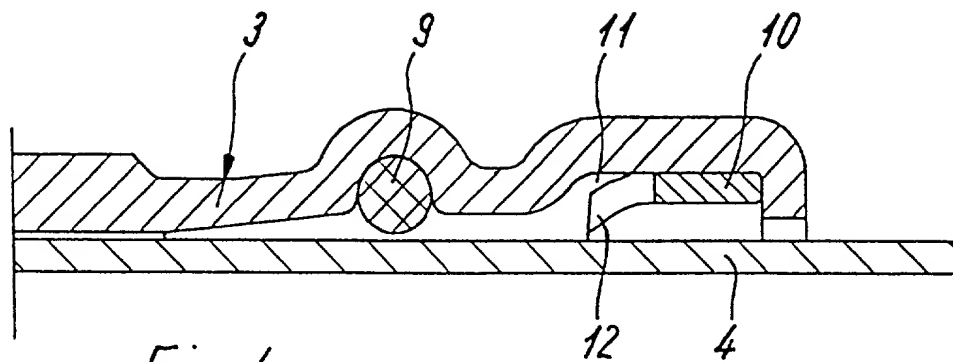


Fig. 4

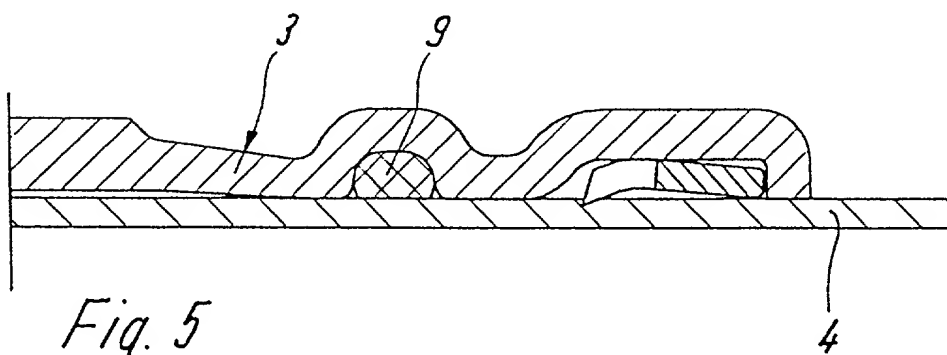


Fig. 5

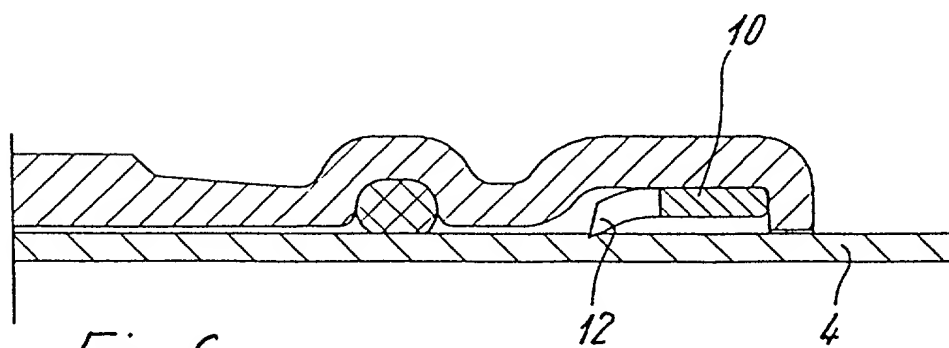
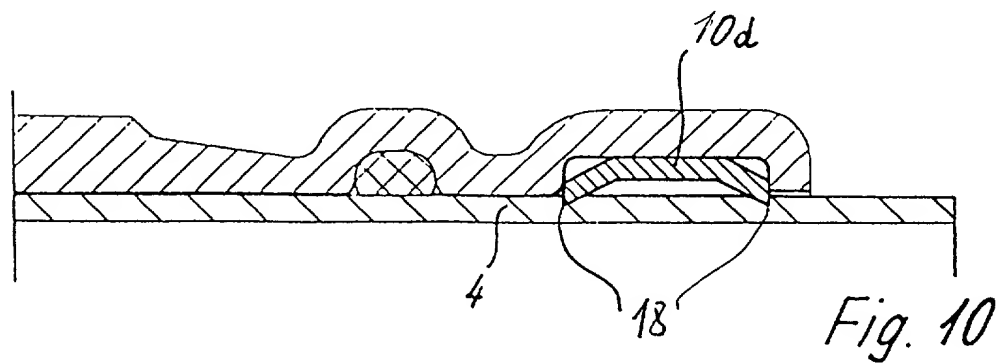
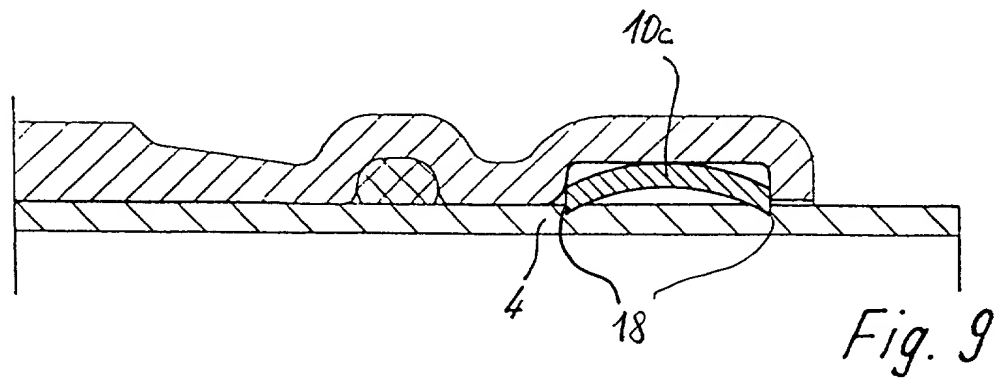
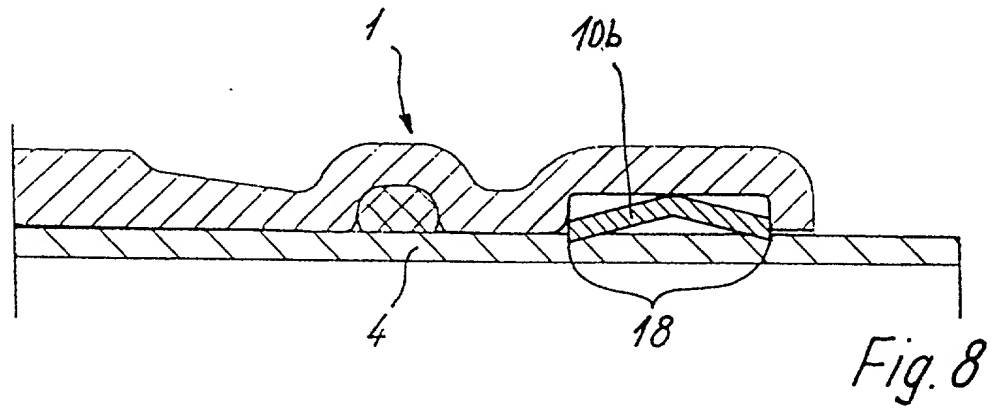
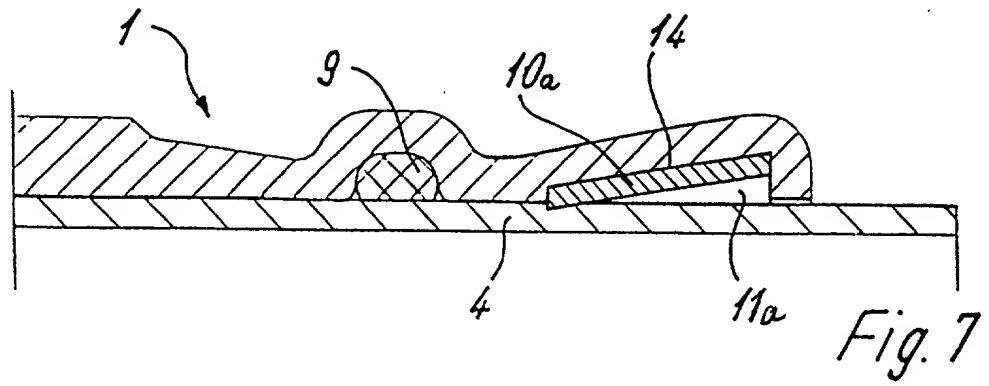
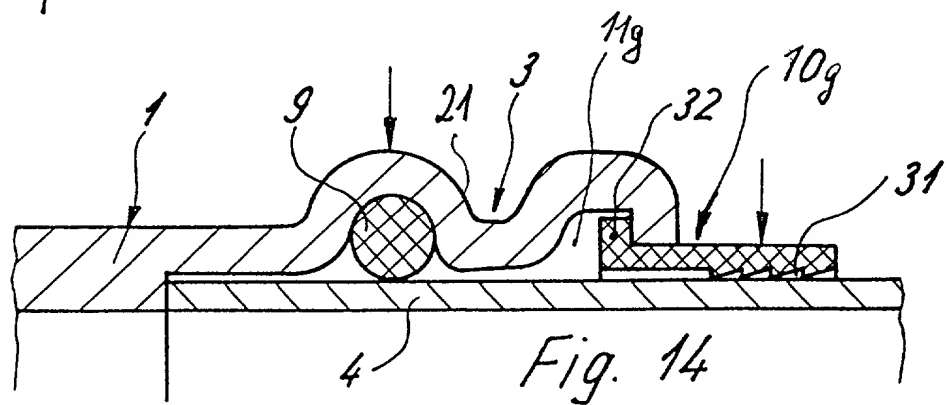
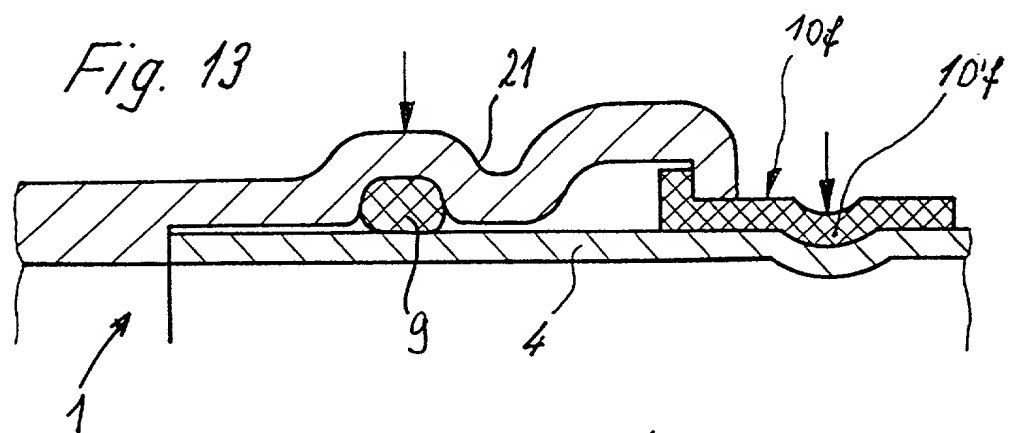
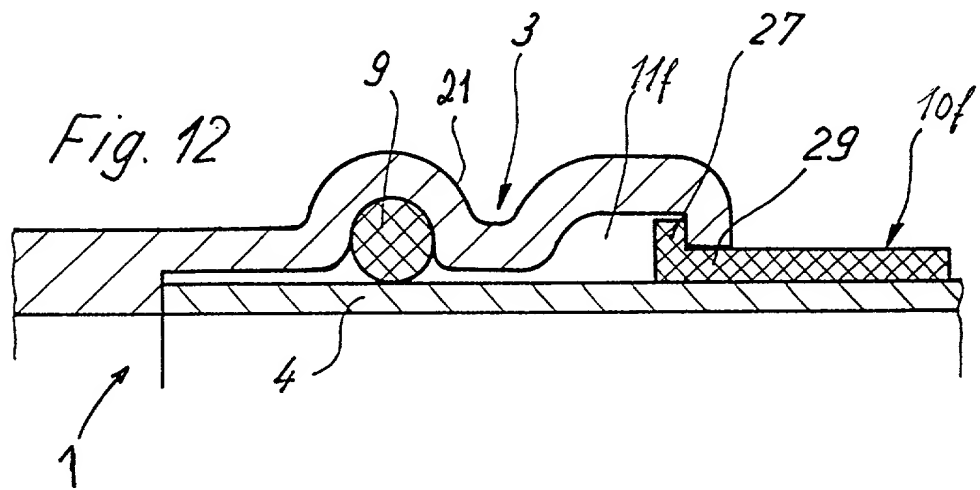
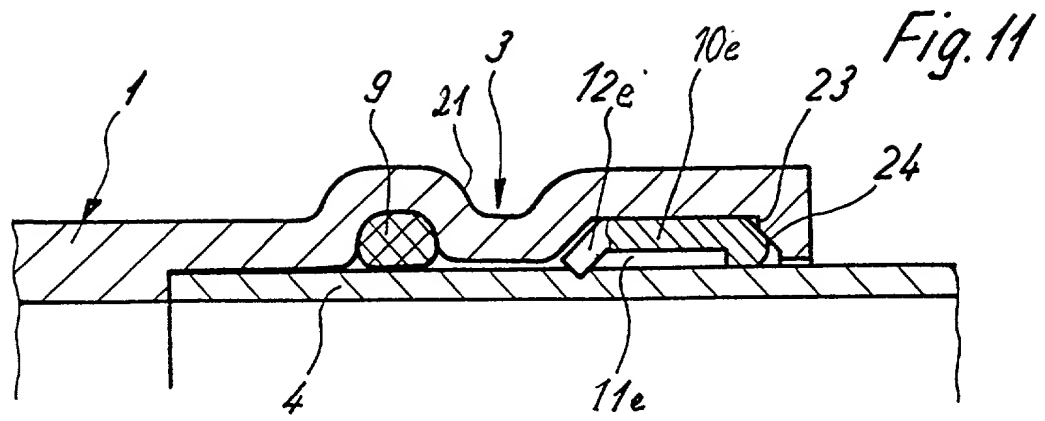


Fig. 6

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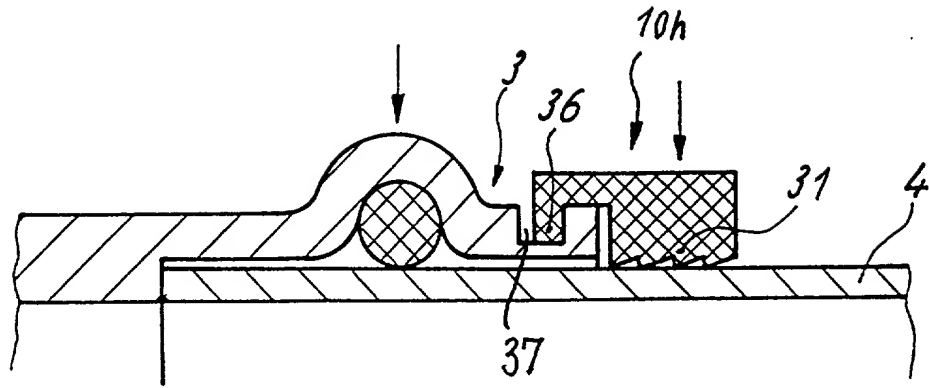


Fig. 15

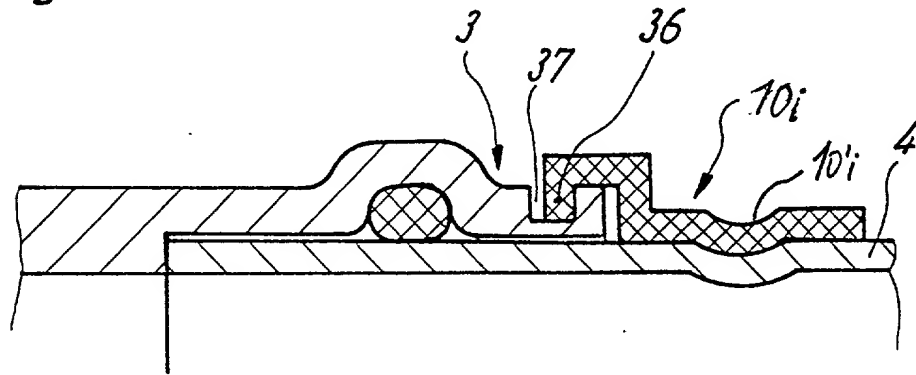


Fig. 16

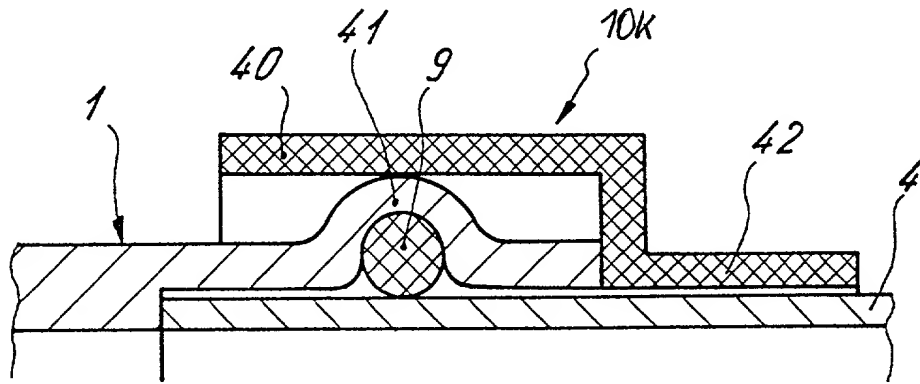


Fig. 17

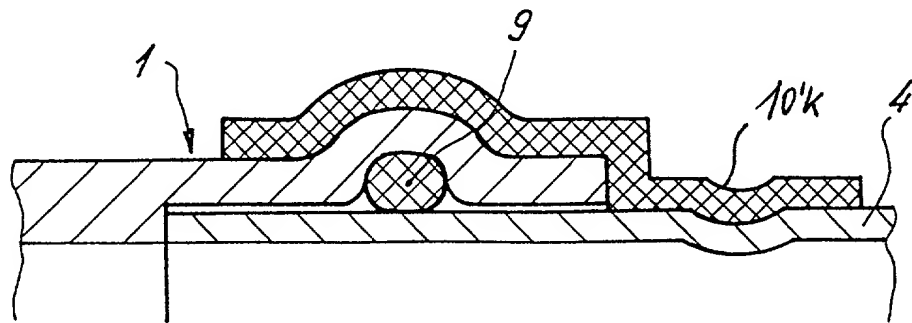


Fig. 18

# Declaration and Power of Attorney for Patent Application

## Erklärung für Patentanmeldungen mit Vollmacht

### German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

daß mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den Im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

daß ich, nach bestem Wissen, der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

**NON-DETACHABLE PRESS FIT ARRANGEMENT  
BETWEEN A FITTING AND AN END PORTION OF A  
METAL PIPE**

deren Beschreibung  
(zutreffendes ankreuzen)

- ☒ hier beigefügt ist.  
☐ wurde angemeldet am \_\_\_\_\_  
 unter der U.S.-Anmeldungs Nr. oder unter der  
 Internationalen Anmeldenummer im Rahmen des  
 Vertrags über die Zusammenarbeit auf dem  
 Gebiet des Patentwesens (PCT)  
 \_\_\_\_\_ und am \_\_\_\_\_  
 \_\_\_\_\_ abgeändert (falls  
 zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag, wie oben erwähnt, abgeändert wurde.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen an, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Titel 37, Code of Federal Regulations, §1.56 von Belang sind.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Titel 35, US-Code, §119(a)-(d), bzw. §365(b) aller unten angegebenen Auslandsanmeldungen für ein Patent oder Erfinderurkunden, oder §365(a) aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereinigten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslandsanmeldungen für Patente oder Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**NON-DETACHABLE PRESS FIT ARRANGEMENT  
BETWEEN A FITTING AND AN END PORTION OF A  
METAL PIPE**

the specification of which  
(check one)

- ☒ is attached hereto  
☐ was filed on \_\_\_\_\_  
 as United States Application Number or PCT  
 International Application Number  
 \_\_\_\_\_ and was amended on  
 \_\_\_\_\_  
 (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications  
(Frühere ausländische Anmeldungen)

Priority Claimed?  
Priorität beansprucht?

297 21 760.7  
(Number)  
(Nummer)

Germany  
(Country)  
(Land)

10 December 1997  
(Day/Month/Year Filed)  
(Tag/Monat/Jahr eingereicht)

☒ [ ]  
Yes No  
Ja Nein

\_\_\_\_\_  
(Number)  
(Nummer)

\_\_\_\_\_  
(Country)  
(Land)

\_\_\_\_\_  
(Day/Month/Year Filed)  
(Tag/Monat/Jahr eingereicht)

[ ] [ ]  
Yes No  
Ja Nein

Ich beanspruche hiermit gemäss Titel 35, US-Code, §119(e), den Vorzug aller unten aufgeführten US-Hilfsanmeldungen

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) below

\_\_\_\_\_  
(Application No. / Anmeldnr.)

\_\_\_\_\_  
(Filing Date / Anmeldedatum)

\_\_\_\_\_  
(Application No. / Anmeldnr.)

\_\_\_\_\_  
(Filing Date / Anmeldedatum)

Ich beanspruche hiermit gemäss Titel 35, US-Code, §120, den Vorzug aller unten aufgeführten US-Patentanmeldungen bzw. §365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung, bzw. PCT internationalen Anmeldung in einer gemäß dem ersten Absatz von Titel 35, US-Code §112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, §1.56 von Belang sind und im Zeitraum zwischen dem Anmeldedatum der früheren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) gültigen internationalen Anmeldedatum bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

\_\_\_\_\_  
(Appl. No.)  
(Anmeldnr.)

\_\_\_\_\_  
(Filing Date)  
(Anmeldedatum)

\_\_\_\_\_  
(Status)  
(patentiert, anhängig  
aufgegeben)

\_\_\_\_\_  
(Status)  
(patented, pending  
abandoned)

\_\_\_\_\_  
(Appl. No.)  
(Anmeldnr.)

\_\_\_\_\_  
(Filing Date)  
(Anmeldedatum)

\_\_\_\_\_  
(Status)  
(patentiert, anhängig  
aufgegeben)

\_\_\_\_\_  
(Status)  
(patented, pending  
abandoned)

Ich erkläre hiermit, daß alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und daß ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, daß wissentlich und vorsätzlich falsche Angaben gemäss §. 1001, Titel 18 US-Code strafbar sind und mit Geldstrafe und/oder Gefängnis bestraft werden können, und daß derartig wissentlich und vorsätzlich falsche Angaben die Rechtswirksamkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**VERTRETUNGSVOLLMACHT:** Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Vertreter mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem US-Patent- und Warenzeichenamt:

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

**HENRY M. FEIEREISEN**

Reg. No. 31,084

Telefongespräche bitte richten an:  
(Name und Telefonnummer)

Direct telephone calls to:  
(Name and telephone number)

**HENRY M. FEIEREISEN**  
(212) 244-5500

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Henry M. Feiereisen  
350 Fifth Avenue, Suite 3220  
New York, N.Y. 10118

Send Correspondence to:

Voller Name des einzigen oder  
ursprünglichen Erfinders

Full name of first inventor

**WALTER VIEGENER**

Unterschrift des Erfinders

Datum

Inventor's Signature

Date

21.11.1998

*Walter Viegener*

Wohnsitz

Attendorf / Germany

Residence

Staatsangehörigkeit

Germany

Citizenship

Postanschrift

Bleikhoferstrasse 26  
57439 Attendorf  
Germany

Post Office Address